

CLAIMS

What is claimed is:

1. An interferometric method for measuring, said method comprising:
generating a first coherent light beam and a second coherent light beam;

reflecting at least said first coherent light beam from a first region into a first return beam and reflecting said second coherent light beam from a second region into a second return beam;

measuring at least a first reflectivity of said first region;

determining a topography-dependent phase shift of said first return beam and said second return beam based on said first reflectivity; and

measuring a height based on said topography-dependent phase shift.
2. The method of claim 1, further comprising:
comparing said first reflectivity and a second reflectivity of said second region; and
using a total phase shift of said first return beam and said second return beam for said height measurement, if said first reflectivity and said second reflectivity are equal.
3. The method of claim 1, wherein said topography-dependent phase shift is determined based on an optical property of an area covered by said first region.
4. The method of claim 1, wherein said determining step further comprises determining the topography-dependent phase shift with reference to a curve relating said first reflectivity to a material-dependent phase shift.

5. The method of claim 1, wherein said determining step further comprises employing a reflectivity of a second region on a reference surface having known optical properties.

6. The method of claim 1, wherein said determining step further comprises measuring a second reflectivity of a second region on said first surface; and

determining the topography-dependent phase shift based on said first reflectivity and said second reflectivity.

7. The method of claim 1, wherein said determining step further comprises determining a fringe visibility for use in determining said topography-dependent phase shift.

8. The method of claim 1, wherein said determining step further comprises determining a topography dependent phase shift through mathematical relationships, comprising:

$$\Delta\varphi_h = \Delta\varphi_T - \Delta\varphi_m;$$

$$\Delta\varphi_m = \arcsin(\alpha);$$

$$\alpha = \frac{r_1 r_2 \sin(\varphi_2 - \varphi_1)}{|(r_1)^2 - (r_2)^2|};$$

$$\beta = \frac{1}{2V} \frac{(R_1)^2 - (R_2)^2}{(R_1)^2 + (R_2)^2};$$

wherein :

$\Delta\varphi_h$ is a topography - dependent_phase_shift;

$\Delta\varphi_T$ is a total_phase_shift;

$\Delta\varphi_m$ is a material - dependent_phase_shift;

r_1 is a reflection_coefficient_of_first_area;

r_2 is a reflection_coefficient_of_second_area;

φ_1 is a phase_shift_caused_by_reflection_from_first_area;

φ_2 is a phase_shift_caused_by_reflection_from_second_area;

R_1 is a reflectivity_of_first_region;

R_2 is a reflectivity_of_second_region; and

V is a fringe_visibility.

9. The method of claim 1, wherein:

the determining step further comprises calculating a material-dependent phase shift based on a first optical property, a second optical property, and a first reflectivity of a first region; and

the determining step further comprises determining a topography-dependent phase shift by subtracting a material-dependent phase shift from a total phase shift of a first reflected coherent light beam and a second reflected coherent light beam.

10. A computer program product in a computer readable medium for measuring, said computer program product comprising:

a computer readable medium;

instructions on the computer readable medium for generating a first coherent light beam and a second coherent light beam;

instructions on the computer readable medium for reflecting at least said first coherent light beam from a first region into a first return beam and reflecting said second coherent light beam from a second region into a second return beam;

instructions on the computer readable medium for measuring at least a first reflectivity of said first region;

instructions on the computer readable medium for determining a topography-dependent phase shift of said first return beam and said second return beam based on said first reflectivity; and

instructions on the computer readable medium for measuring a height based on said topography-dependent phase shift.

11. The computer program product of claim 10, further comprising:
- instructions on the computer readable medium for comparing said first reflectivity and a second reflectivity of said second region; and
- instructions on the computer readable medium for using a total phase shift of said first return beam and said second return beam for said height measurement, if said first reflectivity and said second reflectivity are equal.
12. The computer program product of claim 10, wherein said instructions for determining said topography-dependent phase shift further comprise instructions for determining said topography-dependent phase shift based on an optical property of an area covered by said first region.
13. The computer program product of claim 10, wherein said determining instructions further comprise instructions for determining the topography-dependent phase shift with reference to a curve relating said first reflectivity to a material-dependent phase shift.
14. The computer program product of claim 10, wherein said determining instructions further comprise instructions for employing a reflectivity of a second region on a reference surface having known optical properties.
15. The computer program product of claim 10, wherein said determining instructions further comprise:
- instructions for measuring a second reflectivity of a second region on said first surface; and
- instructions on the computer readable medium for determining the topography-dependent phase shift based on said first reflectivity and said second reflectivity.

16. The computer program product of claim 10, wherein said determining instructions further comprise instructions for determining a fringe visibility for use in determining said topography-dependent phase shift.

17. The computer program product of claim 10, wherein said determining instructions further comprise instructions for determining a topography dependent phase shift through mathematical relationships, comprising:

$$\Delta\varphi_h = \Delta\varphi_T - \Delta\varphi_m;$$

$$\Delta\varphi_m = \arcsin(\alpha);$$

$$\alpha = \frac{r_1 r_2 \sin(\varphi_2 - \varphi_1)}{|(r_1)^2 - (r_2)^2|};$$

$$\beta = \frac{1}{2V} \frac{(R_1)^2 - (R_2)^2}{(R_1)^2 + (R_2)^2};$$

wherein :

$\Delta\varphi_h$ is a topography - dependent_phase_shift;

$\Delta\varphi_T$ is a total_phase_shift;

$\Delta\varphi_m$ is a material - dependent_phase_shift;

r_1 is a reflection_coefficient_of_first_area;

r_2 is a reflection_coefficient_of_second_area;

φ_1 is a phase_shift_caused_by_reflection_from_first_area;

φ_2 is a phase_shift_caused_by_reflection_from_second_area;

R_1 is a reflectivity_of_first_region;

R_2 is a reflectivity_of_second_region; and

V is a fringe_visibility.

18. The computer program product of claim 10, wherein:
- the determining instructions further comprise instructions for calculating a material-dependent phase shift based on a first optical property, a second optical property, and a first reflectivity of a first region; and
- the determining instructions further comprise instructions for determining a topography-dependent phase shift by subtracting a material-dependent phase shift from a total phase shift of a first reflected coherent light beam and a second reflected coherent light beam.
19. An interferometer for measuring height said interferometer comprising:
- means for generating a first coherent light beam and a second coherent light beam;
- means for reflecting at least said first coherent light beam from a first region into a first return beam and reflecting said second coherent light beam from a second region into a second return beam;
- means for measuring at least a first reflectivity of said first region;
- means for determining a topography-dependent phase shift of said first return beam and said second return beam based on said first reflectivity; and
- means for measuring a height based on said topography-dependent phase shift.
20. The interferometer of claim 19, further comprising:
- means for comparing said first reflectivity and a second reflectivity of said second region; and
- means for using a total phase shift of said first return beam and said second return beam for said height measurement, if said first reflectivity and said second reflectivity are equal.

21. The interferometer of claim 19, wherein said means for determining said topography-dependent phase shift further comprise means for determining said topography-dependent phase shift based on an optical property of an area covered by said first region.

22. The interferometer of claim 19, wherein said determining means further comprise means for determining said topography-dependent phase shift with reference to a curve relating said first reflectivity to a material-dependent phase shift.

23. The interferometer of claim 19, wherein said determining means further comprise means for employing a reflectivity of a second region on a reference surface having known optical properties.

24. The interferometer of claim 19, wherein said determining means further comprise means for measuring a second reflectivity of a second region on said first surface; and

means for determining the topography-dependent phase shift based on said first reflectivity and said second reflectivity.

25. The interferometer of claim 19, wherein said determining means further comprise means for determining a fringe visibility for use in determining said topography-dependent phase shift.

26. The interferometer of claim 19, wherein said determining means further comprise means for determining a topography dependent phase shift through mathematical relationships, comprising:

$$\Delta\varphi_h = \Delta\varphi_T - \Delta\varphi_m;$$

$$\Delta\varphi_m = \arcsin(\alpha);$$

$$\alpha = \frac{r_1 r_2 \sin(\varphi_2 - \varphi_1)}{|(r_1)^2 - (r_2)^2|};$$

$$\beta = \frac{1}{2V} \frac{(R_1)^2 - (R_2)^2}{(R_1)^2 + (R_2)^2};$$

wherein :

$\Delta\varphi_h$ is a topography - dependent_phase_shift;

$\Delta\varphi_T$ is a total_phase_shift;

$\Delta\varphi_m$ is a material - dependent_phase_shift;

r_1 is a reflection_coefficient_of_first_area;

r_2 is a reflection_coefficient_of_second_area;

φ_1 is a phase_shift_caused_by_reflection_from_first_area;

φ_2 is a phase_shift_caused_by_reflection_from_second_area;

R_1 is a reflectivity_of_first_region;

R_2 is a reflectivity_of_second_region; and

V is a fringe_visibility.

27. The interferometer of claim 19, wherein:

the determining means further comprise means for calculating a material-dependent phase shift based on a first optical property, a second optical property, and a first reflectivity of a first region; and

the determining means further comprise means for determining a topography-dependent phase shift by subtracting a material-dependent phase shift from a total phase shift of a first reflected coherent light beam and a second reflected coherent light beam.